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**DOOR WITH LOCKSET**

This application claims the benefit of co-pending provisional application US  
5 Serial No. 60/254,325 filed December 8, 2000.

**Field of the Invention:**

The invention pertains to doors. More particularly, the present invention pertains to storm doors and structures for supporting mortise locks within storm doors.

**Background of the Invention:**

10 The architectural location of storm doors tends to dictate that they exhibit relatively small depth so as to be light weight and easily installable in a variety of applications. They must be sufficiently strong to withstand substantial forces due to opening and closing as well as impact forces as various objects are moved near or through the respective door frames. They must also withstand slamming of the door  
15 by the users and withstand strong winds.

The doors must remain effective and operable over wide temperature ranges and humidity conditions. They must withstand the deteriorating effects of variations in weather over long periods of time while retaining an acceptable appearance.

To meet the above criteria, a variety of different materials have been used for  
20 storm doors. Known storm doors can be formed of wood, particle board, medium density fiberboard, honeycombed material, vinyl, foam filled styrene, composite wood, engineered wood-type materials, as well as foamed resins. Often a combination of these materials is used. Other types of particulate material as well as other polymer based materials have also been used.

25 Representative storm door structures have been disclosed in US Patents 5,161,346 and 5,077,948 assigned to the assignee of the present application. Those patents are incorporated herein by reference.

Storm doors usually include some form of a lock mechanism so as to enable the consumer or home owner to lock the storm door and leave the interior, primary solid  
30 security door open. Mortise lock assemblies have been used in known storm doors.

One such configuration has been disclosed and claimed in United States Patent Application Serial No. 09/911,604 entitled Wood Core Exterior Door With Mortise Lock filed July 24, 2001 and assigned to the assignee hereof. That application is incorporated herein by reference. In the subject application, in one embodiment,  
5 multiple sections of a stile are combined with a lock receiving container to form unitary stiles. The unitary stiles can be combined with rails or kick plates to form a door.

While the structure of the above-noted application, incorporated herein by reference, is useful and effective for its intended purpose, in some door designs, unlike  
10 the door disclosed in the above-noted application, a unitary core is used. Alternately, unitary stiles can be used. In such designs where the edges of the core or the stiles are bored or drilled for the purpose of installing mortise-type locks, potential problems may arise given the thickness of the core or the stiles versus the width of the borings or openings necessary to receive the lock. Hence, care must be taken not to weaken  
15 the respective core or stile in the vicinity of where the mortise lock is to be installed.

There thus continues to be a need for storm doors bored to receive mortise locks in such a way as to maximize available cross sectional strength of the door, in the vicinity of the boring for the mortise lock. In addition, in doors with moisture absorbing cores, wood or wood-like cores, it would be desirable to prevent moisture  
20 from traveling from a lock or lock cavity into the door core.

**Summary of the Invention:**

The invention provides an improved door construction, such as for a storm door. The door includes right and left vertical members, a head panel and a base panel or, rails. Alternately, the door can have a unitary core with cut-outs for glass or screen  
25 inserts.

The vertical edges each have an elongated opening or slot having curved ends joined by planer sides such that the available cross sectional strength of the respective door is maximized in the vicinity of the boring. With molded cores, appropriately shaped elongated openings can be molded in spaced apart vertical core edges. In a  
30 preferred embodiment, a ratio of the radius of the ends of the slot to the width thereof exceeds 0.4.

In one disclosed embodiment, a metal or plastic sleeve can be slid into and frictionally retained within a respective opening or slot to provide a moisture seal and prevent moisture from the lock or the slot(s) from migrating into the core as well as to improve strength and stability of the respective core or door.

5           The sleeves can each carry stile or core engaging protrusions which extend laterally from the respective sides of the sleeve to improve retention force. Alternately, the sleeves can be held in place with adhesive. A sealant can be incorporated between the opening and the sleeve to further enhance moisture resistance.

10           In a disclosed embodiment, a narrow mortise lock having a live bolt with a height on the order of  $3/4$  -  $7/8$  of an inch can be installed in the opening with or without a sleeve. Where used with a sleeve, the lock can have a housing which extends into the sleeve, and, has an exterior cross section which matches an interior cross section of the sleeve. Alternately, the mortise lock can be sized and shaped to be used without a sleeve or insert and can be installed directly into the elongated opening.

15           In a preferred embodiment, both edges of the door are bored substantially identically. Depending on which side of the door is hinged, that respective opening can be closed with a snap-fit cover.

20           The present invention is especially advantageous when embodied in doors, with a width less than one inch, on the order of  $3/4$  of an inch thick. In such embodiments, the slot or opening, as a result of its cross section, can be formed in the edge of the core with a width on the order of five-eighths of an inch with five-sixteenth inch end radii. The end radii which result, for example in semicircular cylindrical end regions, provide greater core strength in the vicinity of the ends than would be available in the presence of substantially square corners.

25           The width of the opening can be filled with a sleeve in combination with a narrow mortise lock. The sleeve can be separate from or attached to the mortise lock. Alternately, the lock can be sealed and sized to slidably fit into the opening without a sleeve.

30           Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

**Brief Description of the Drawings:**

Fig. 1A is an isometric view of a door in accordance with the present invention;  
Fig. 1B is an enlarged, partial, exploded isometric view of a core for the door  
of Fig. 1A;

5 Fig. 1C is an exploded top plan view of a portion of the door of Fig. 1A;

Fig. 2 is a partial, exploded, enlarged isometric view of a portion of the door of  
Fig. 1A;

Figs. 3A-3E illustrate various views of a sleeve usable in the door of Fig. 1A;

Fig. 4 illustrates an exemplary mortise lock usable in the door of Fig. 1A;

10 Fig. 5A is an enlarged fragmentary exploded view of a portion of the mortise  
lock mechanism installed in the door of Fig. 1A;

Fig. 5B is a sectional view taken along plane 5B-5B of Fig. 5A;

Fig. 5C is a sectional view taken along plane 5C-5C of Fig. 5A;

15 Figs. 6A-6D illustrate various views of a sleeve closing snap-in cover of a type  
usable in the door of Fig. 1;

Fig. 7A illustrates an enlarged, isometric view of a portion of a door with an  
alternate lock embodiment;

Fig. 7B is a sectional view of the embodiment of Fig. 7A taken along plane 7B-  
7B;

20 Fig. 7C is a sectional view of the embodiment of Fig. 7A taken along plane 7C-  
7C; and

Fig. 8 is an exploded isometric view of an alternate embodiment of the  
invention.

**Detailed Description of The Preferred Embodiments:**

25 While this invention is susceptible of embodiment in many different forms,  
there are shown in the drawing and will be described herein in detail specific  
embodiments thereof with the understanding that the present disclosure is to be  
considered as an exemplification of the principles of the invention and is not intended  
to limit the invention to the specific embodiments illustrated.

30 Figs. 1A, 1B and 1C illustrate respectively isometric, exploded and top plan  
exploded views of a storm door 10 in accordance with the present invention. The door

10 includes a core, indicated generally at 12, best seen in Fig. 1B, which could be formed as a single unitary structure with a central cut-out region 14 formed therein for receipt of glass or screen inserts of a type normally used with storm doors as would be understood by those of skill in the art. Alternately, the core 12 can be formed of a plurality of severally assembled elements such as vertical stiles, kick panel and top rail which can be assembled together to form a core with an opening corresponding to the opening 14. Also as would be understood by those of skill in the art, the core 12 for the storm door 10 can be covered on its exterior and interior faces, such as 12a, 12b as well as edges 12c, d, e and f with sheet metal such as aluminum, 12a', b', c', d', e' and f' to improve appearance as well as to improve resistance to the elements.

The core 12 can be formed of a variety of materials such as wood, particle board, medium density fiberboard, honeycombed materials, vinyl, foam filled styrene, composite wood, engineered wood-type materials as well as foamed resins. Other types of particulate material as well as other polymer based materials can also be used.

The door 10 includes first and second substantially identical elongated slots or openings 20a, 20b formed in the respective edges 12c, 12d. The slots or openings 20a, 20b are elongated and preferably with semicircular ends 21a, b best seen in Fig. 5B. The curved end regions are joined by two elongated planer sides 21c, d.

For example, and without limitation, where the width of the core 12 for the door 10 is on the order of three-quarters of an inch wide, the openings 20a, 20b can be formed as five-eighths inch wide slots with five-sixteenth inch radius circular end regions. Representative maximal lengths of the slots are on the order of 1.3 inches long.

As a result of providing slots 20a, 20b along each edge of the door 10, the door can readily be hinged on either edge. The unused slot can be covered by a snap-in cover 22. Exterior sheeting, such as 12c', 12d' can be slotted with a similar or square cross section.

The door 10 is especially advantageous in that despite its narrowness, on the order of less than one inch, preferably three-quarters of an inch wide, the form of the slots 20a, 20b, with the semicircular ends 21a, b noted above, leaves additional material in the core that would not otherwise be present, thereby increasing the cross-sectional

strength of the core in the vicinity of the slots 20a, 20b beyond what would be case for a substantially square slot. Hence, the semicircular end regions 21a, b for the slot 20a contribute to door strength, more so than square slots, in the presence of a narrow core.

5 The door 10 also includes first and second plastic or metal sleeves or inserts 24a, 24b, best seen in Fig. 1B, 3A, which slide into and fill the respective elongated slots 20a, 20b. The sleeves or inserts 24a, 24b both provide a moisture seal relative to the slots 20a, 20b such that moisture entering or present within the respective insert 24a, 24b is blocked from migrating into the core 12 in the vicinity of the slots. Additionally, the presence of the sleeves 24a, 24b provides additional strength and  
10 stiffening for the door in the vicinity of the respective slots 20a, 20b thereby improving door strength.

A mortise lock 26 is slidably positioned in a respective sleeve, such as the sleeve 24a in the slot 20a. Lock 26 can be slidably received in the sleeve 24a with a friction fit or, alternately, can be attached to the edge 12e of the core 12 through sheet  
15 12e', by screws or other fasteners via integrally attached plate 26a. It will be understood that the lock 26 can be sized to take advantage of the narrow elongated insert 24a, as discussed subsequently.

The lock 26 incorporates a live bolt 26b which moves laterally in a housing 26c from an extended, locked position to a retracted position. A mechanism within the  
20 housing 26c couples the live bolt 26b to a rotary actuating port 26d which has an axis of rotation R.

The actuating port 26d includes an opening with a square cross section which receives an actuating shaft or spindle 28a which has a corresponding square cross section. The shaft or spindle 28a is in turn coupled to rotatable handles 28b and 28c  
25 which in turn are attached to the door 10 via escutcheons 30a, 30b.

Rotating either handle 28b or handle 28c in turn rotates shaft or spindle 28a which extends through the port 26d on the axis R. This in turn retracts the live bolt 26b from an extended, locking position to a retracted, unlocking position. Releasing the respective handle permits a spring or biasing element in housing 26c to restore bolt 26b  
30 to its locking position.

The shaft or spindle 28a extends through openings 24a-1, -2 in the side walls of a respective sleeve such as the sleeve 24a.

Figs. 3A-3E illustrate various views of insert 24a. Insert 24b is substantially identical to insert 24a. A discussion of insert 24a applies to both.

5 The insert 24a includes first and second curved end walls 24a-3 and 24a-4. The end walls 24a-3, -4 are joined by spaced-apart planer side walls 24a-5 and 24a-6. The elongated exterior shape of the insert 24a slidably matches and engages the elongated respective slot, such as the slots 24a, b in the door 10.

10 The insert 24a is formed with a substantially constant wall thickness 24a-7 and encloses a bounded lock receiving region 24a-8. The insert 24a is closed with an end wall 24a-9 which is distally located relative to the slot 20a such that the end wall 24a-9 is located in the vicinity of an end wall of the respective slot 20a.

15 First and second core engaging protrusions 32a, b extend laterally from the insert 24a and slidably engage the core 12 with a friction fit when the insert 24a is driven into the slot 20a. The insert 24a terminates at a proximal end at an edge 24a-10 which is adjacent to the edge of the core 12c.

20 Fig. 4 illustrates additional details of exemplary lock 26. As illustrated in Fig. 4, the mortise lock 26 incorporates a housing 26c having first and second spaced apart curved side walls 40a, 40b joined by spaced apart planer walls 40c, 40d. When slidably installed in a respective insert, best seen in Figs. 5B, C such as the insert 24a, the side walls 40c, 40d of the mortise lock 26, slidably engage respective interior surfaces of the side walls 24a-5, -6 precluding rotation of the lock 26 relative to the insert 24a or b.

25 The housing 26c can be formed of metal or plastic. Housing 26c can be sealed against moisture so that it could be inserted into slot 20a or 20b without need of a separate insert, such as insert 24a, b. Alternately, the respective insert such as 24a can be permanently attached to the lock 26, and the combination can be inserted into the respective door slot or opening.

30 The height and curvature of the curved side walls 40a, 40b of the housing 26c can correspond to the elongated interior cross section of the inserts 24a, b. Alternately,

the height of the side walls 40a, 40b can be less than the interior height between the curved ends 24a-3, -4 of the insert 24a.

5 The lock 26 also carries an insertion limiting surface, illustrated as surface 26e in Fig. 4. This surface limits the extent to which the housing 26c extends into the region 24a-8 of the insert 24a.

The lock 26 can be retained in the respective insert 24a, b by frictional forces. Alternately, openings 44a and 44b can be provided for screws or other fasteners to mechanically attach the lock 26 to the edge 12c of the door 10.

10 Figs. 5A, B, C illustrate further aspects of the relationships between the edge 12c of core 12 and the respective elongated opening or slot 20a, the respective insert such as the insert 24a or b and the respective mortise lock 26. Figs. 6A-D illustrate details of molded snap-on cover 22.

15 Cover 22 has an elongated rectangular body 60 with spaced apart elongated edges 60a, b. Each of the edges 60a, b carries respective slidable or snap-engagable flanges 62a, b. As illustrated in Fig. 6D, the respective flanges 62a, b deflect and engage edges of either exterior edging 12c' d' thereby closing an unused one of the slots 20a, b.

20 The following parameter illustrates additional aspects of the present invention which makes it possible to reliably install a mortise lock in a narrow core door on the order of three-quarters inch wide or narrower. In such three-quarter inch cores, the slots 20a, b are preferably on the order of five-eighths inch wide with five-sixteenths of an inch end radii. Maximum slot length can vary depending on a height parameter of the insert 20a, b.

25 Where height of live bolt 26b is in a range of three-quarters to seven-eighths of an inch, an interior height of sleeve 24a, b on the order of one and one-quarter inch with a width on the order of .56 inches will accommodate a lock housing 26c on the order of one inch high and one-half inch wide in a five-eighths inch wide slot 20a, b. A sleeve with an exterior width of .625 inches and .030 thick walls will accommodate such a lock housing.

30 To provide a live bolt 26b movable on the order of one-half inch from an extended locking position, illustrated in Fig. 5A, to a fully retracted position against



surface 26a-1, the rotary axis R can be set back on the order of one and one-eighth inch to accommodate the narrow door width.

Figs. 7A-7C illustrate respectively an exploded and two sectional views of an alternate embodiment of a lock in accordance with the present invention. In the embodiment 70, those elements which are substantially identical to the elements previously discussed have been assigned the same identification numerals. In the embodiment 70, a mortise lock 26' is formed with a housing 26c' which can be installed in a door 10 without any need for a sleeve or inserts such as the sleeve or insert 24a, b. In this circumstance, the housing 26c' completely fills the respective slot 24a, 24b.

The housing 26c' for the lock can be sealed with an integral plastic layer. Alternately, it can be formed of moisture resisting sealed metal or plastic such that when inserted into the respective edge opening it substantially excludes moisture from the respective door core, such as core 12 (which could be a wood or wood-based material susceptible to absorbing moisture.)

Fig. 8 illustrates an alternate door 10' which has an elongated oval opening 12'' cut into an edge 10a' which is adjacent a side of the door frame to which the door is to be locked. For example, the opening 12'' could have upper and lower curved edges, such as semicircles, joined by planar side surfaces.

A sleeve 14', molded plastic or metal is driven into the oval opening 12''. The sleeve 14' has an external oval cross section which matches the peripheral shape of the oval opening. The sleeve 14' is hollow with a non-circular interior cross section 14a'. For example, circular, oval, rectangular or triangular exterior or interior cross sections could be used. The sleeve 14' can carry exterior features, ridges, extensions protrusions or the like 16', to lock the sleeve to the door.

A second opening 18' is cut into faces 10b', c' of the door 10'. The faces 10b', c' are perpendicular to the edge 10a'. The second opening 18' extends between the faces of the door, with a central axis that is parallel to the edge 10a' and intersects the oval opening 12''.

A latch mechanism 20' which, at least in part, has an exterior peripheral surface 20a' which corresponds to the shape of the interior periphery 14a' of the sleeve 14' is

inserted into the sleeve and retained in place by the sleeve. An actuating shaft opening 20b' is located adjacent feature 20a'.

5 The shaft opening 20b' in the distal end of the latch mechanism is aligned with the second opening 18', through the faces 10b', c' of the door and through a lateral opening 14b' in the sleeve 14'. A latch actuating shaft 22' extends through the aligned second opening 18', the lateral opening 14b' in the sleeve and the shaft opening 20b' through the latch mechanism. Rotating the shaft 22' retracts a latch bolt 20c' in the latch mechanism 20' unlocking the door from the frame. Handles can be attached to each end of the shaft 22' on opposite sides of the door 10'.

10 When the door 10' is closed, the exterior end of the latch bolt 20c' extends into the adjacent frame locking the door thereto. Rotating the shaft 22' retracts the exterior end of the latch bolt 20c' into the latch mechanism 20' unlocking the door.

During manufacture, the door 10' can be bored not only on the edge 10a' but on the opposite edge with an opening such as the opening 12'' to receive two sleeves 15 14' to facilitate reversible lock installation on the door. With this configuration, the door can be readily equipped with a lock set on either edge to provide for either a right-hand swing or a left-hand swing of the door. In this instance, the sleeves 14' could each be closed with a removable cap. When the lock set is installed, the cap can be removed from the appropriate sleeve and the other cap left in place to cover the adjacent sleeve and provide an attractive essentially smooth door edge on the hinged side. 20

It will also be understood that the sleeves or inserts such as 24a, b or 14' can be made part of or attached to the respective mortise lock such as lock 26 or 20'. Alternately, the housing for the respective lock, such as lock 26 or 20' can be formed 25 as a sealed plastic housing which slidably engages an opening round, elongated, square, rectangular, triangular or the like in the edge of the respective door.

The mortise lock 26' can be attached to the door 10 using plate 26a and installing screws or other fasteners in openings 44a, b into the edge 12c' of the door 10.

30 From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific

apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.